

## Allergenic pollens in the southern Mediterranean area

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*In the Mediterranean area there are characteristic climatic conditions (mildness of winter, summer dryness, etc.) that facilitate the growing of a typical vegetation with production of allergenic pollen, such as those from *Parietaria* and *Olea europaea*, very different from that of central and northern Europe. We present in this article the results of an 8-year pollen count in the atmosphere of Naples, Italy. The pollen content was examined with a volumetric spore trap (Lanzoni VPPS-2000) like that of Hirst. The results of the pollen counts were subsequently compared with results of skin tests of patients born and still living in and around Naples to determine the pollinosis of that area. We found that the most important allergenic pollen in the Naples area is *Parietaria*, with very long-lasting periods of pollination. The first period, more important, occurring from March to July, and the second period of much lower intensity, occurring from the end of August to the end of October. Pollen allergy to *Parietaria* was found to be present in 82.02% of pollen-allergic patients. It was followed by Gramineae (38.12%), *Olea* (23.11%), and *Artemisia vulgaris* (17.08%). These data are quite different from data of the pollinosis in northern Italy and in the northern Mediterranean area, as well as the southern coast of France, where allergic sensitization to Poaceae is the most important. (J ALLERGY CLIN IMMUNOL 1989;83:116-22.)*

Knowledge of the atmospheric pollen concentration found in different regions is of great interest for clinicians and allergic patients in establishing a chronologic correlation between the concentration of pollen in the air and the symptoms of hay fever and asthma to achieve a better management of these diseases. In fact, the seasons of the different pollen types vary from country to country, depending on the climate and on the vegetation.

As a result of the characteristic climatic conditions in the Mediterranean area, we find a typical vegetation with production of allergenic pollens, such as that from *Parietaria* and *Olea*, very different from that of central and northern Europe.

Italy has a central position in the Mediterranean basin, but because of its geographic characteristics, there are different climatic aspects with different vegetations between the northern, central, and southern areas. As a result, the frequency of allergic sensitizations to the pollens is different between northern

Abbreviation used  
SPT: Skin prick test

and central Italy, where the pollens of Gramineae (Poaceae) are the most important, and in southern Italy, where *Parietaria* is the major pollinating plant with reference to respiratory allergy (rhinitis and asthma).

We present in this article the results of an 8-year (May 1, 1979, to October 30, 1987) aerobiologic study on allergenic pollens in the atmosphere of Naples, and the results of a study on the frequency of skin test positivity to aeroallergens of allergic atopic patients living in southern Italy.

### MATERIAL AND METHODS

#### Pollen count

Pollen count was performed with a VPPS-2000 (Lanzoni, Bologna, Italy) 7-day recording volumetric spore trap. This device is a new model of Hirst-like pollen trap with the same geometry and technical characteristics as the Hirst trap<sup>1</sup> but with the integration of some expedients that facilitate its use. The trap was placed on the flat roof of a building near the Cardarelli Hospital at about 25 m above the ground, thus giving a clear picture of the average pollen distribution in that area.

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TABLE I. Presence of airborne pollen and skin test positivity

Leiden (Spieksma <sup>18</sup> )				Montpellier (Bousquet et al. <sup>17</sup> )				Naples (D'Amato)			
Airborne presence	%	Skin test positivity	%	Airborne presence	%	Skin test positivity	%	Airborne presence	%	Skin test positivity	%
<i>Urtica</i>	30	Poaceae	90	Cupressaceae	15	Poaceae	86	Urticaceae	42	<i>Parietaria</i>	82
Poaceae	22	<i>Alnus</i>	6	Poaceae	14	<i>Plantago</i>	36	Poaceae	12	Poaceae	38
<i>Betula</i>	8	<i>Betula</i>	5	<i>Quercus</i>	13	<i>Parietaria</i>	27	<i>Olea</i>	10	<i>Olea</i>	23
<i>Alnus</i>	7	<i>Artemisia</i>	4	<i>Plantago</i>	8	Cupressaceae	15	Corylaceae	7	<i>Artemisia</i> <i>vulgaris</i>	17
<i>Salix</i>	4	<i>Quercus</i>	3	<i>Pinus</i>	7	Oleaceae	15	<i>Alnus</i>	6	<i>Plantago</i>	7
<i>Pinus</i>	3	<i>Urtica</i>	2	<i>Platanus</i>	6	<i>Platanus</i>	13	<i>Platanus</i>	5	<i>Chenopodium</i>	3
<i>Quercus</i>	3	<i>Fraxinus</i>	2	Oleaceae	4	<i>Trifolium</i>	13	<i>Artemisia</i>	4	<i>Platanus</i>	2
<i>Populus</i>	3	<i>Rumex</i>	2	Urticaceae	3	<i>Medicago</i>	13	Cupres- saceae	3	Cupressaceae	2
Cupressaceae	3	<i>Plantago</i>	2	Artemisiae	1	<i>Artemisia</i> <i>vulgaris</i>	9	Cheno- podi- aceae	2	<i>Corylus</i>	2

Airborne presence (percent of total yearly pollen counts) and skin test positivity (percent positive reactions in patients with pollinosis) at three European locations: Leiden, The Netherlands, northern European area (3211 patients tested); Montpellier, France, northern Mediterranean area (326 patients); and Naples, Italy, central Mediterranean area (785 patients).

The air is sucked by a pump adjusted to 10 L/min (14.4 m<sup>3</sup>/24 hr). The orifice (2 by 14 mm) is permanently directed toward the wind by a rotating air vane. The particle content of the sucked air is deposited on a sticky tape moving 2 mm/hr. The sticky tape is a cellulose acetate ribbon coated with a solution of 2% silicon fluid (two and one half million stokes viscosity) in carbon tetrachloride. The adhesive tape, mounted on the drum (rotating in the trap at 2 mm/hr) was changed every week, divided into seven segments 48 mm long, each corresponding to 1 day of sampling, and mounted on slides. The slides, with adhesive segments, were covered with fuchsin-stained glycerol jelly and with cover glasses.

The daily mean concentration of the number of pollen particles was carried out by use of an optical microscope for measuring tangential microscopic fields on the slide. The surface area under inspection was calculated by multiplying the area of a single microscope field by the number of cycles of each strip. An algorithm was used to calculate a conversion factor that considers the area of the microscopic field, the adopted magnification, and the number of tested stripes. This value, multiplied by the number of particles counted, elicited the average concentration for 1 m<sup>3</sup> of air examined.<sup>2</sup> Daily mean concentration per cubic meter of air:

$$p \times \frac{672 \text{ mm}^2}{((0.29 \times 0.29 \times 3.14) \times 4 \times 82.75)} \times \frac{1}{14.4} =$$

$$p \times \frac{672}{87.33} \times \frac{1}{14.4} = p \times 0.53 = \text{conversion factor}$$

where 672 mm<sup>2</sup> is the total surface area of the sample (14 by 48 mm), (0.29 by 0.29 by 3.14) elicits the area of a single microscopic field, 4 is the number of tested strips,

and 82.75 is the number of tangential fields for each strip, which can be obtained by dividing 48 mm by 0.58 mm (diameter of the microscopic field used by the operator). The tested area is 87.33 mm<sup>2</sup>, that is, more than one eighth (13%) of the sampling area.<sup>2</sup>

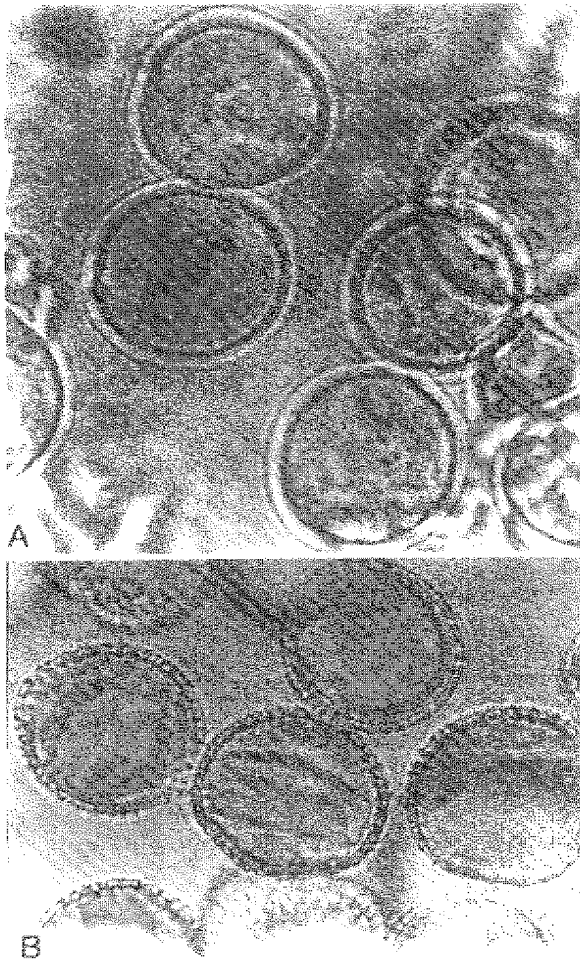
## Patients

We have evaluated the percent frequency of skin test positivity to common aeroallergens on one group of 2649 patients of both sexes (1019 children and 1630 adults) that had come spontaneously to our observation consecutively from January 1, 1981, to May 30, 1983.

Patients were selected on the basis of a history of rhinitis and/or asthma, seasonal or perennial. The age of the children ranged from 4 to 13 years, whereas the age of the adults ranged from 14 to 60 years. The patient's evaluation was made by physician assessment that included in each subject a case history, clinical examination, SPT, and, eventually, RAST. Among this group we have selected the patients with SPT positivity only to pollens and with seasonal clinical symptoms. There were 785 patients of both sexes (98 children and 687 adults) born and still living in and around Naples.

## SPT

Patients were tested by a prick puncture of glycerinated allergenic extracts (Dome-Hollister-Stier-Bayropharm Laboratories, Milan, Italy, 10,000 PNU/ml) by use of a panel of common inhalant allergens: *Dermatophagoides pteronyssinus* and *farinae*, cat and dog dander, molds (*Alternaria*, *Cladosporium* and *Aspergillus*), pollens (*Parietaria judaica* and *officinalis*, Poaceae (*Holcus lanatus*, *Dac-*



**FIG. 1.** Pollen grains in light microscopic view. Original magnification  $\times 1000$ . **A**, *Parietaria judaica* pollens. Grain is spheroidal, triporate, and very small (13 to 17 by 14 to 18  $\mu\text{m}$ ). **B**, *Olea europaea* pollens. Pollen grain is tricolporate, spheroidal, and rather small or medium sized (22 to 25 by 20 to 24  $\mu\text{m}$ ).

*tylis glomerata* and *Cynodon dactylon*), *Olea europaea*, *Artemisia vulgaris*, *Plantago*, *Platanus*, Cupressaceae, *Chenopodium*, *Corylus*, *Betula*, *Quercus*, *Alnus*, *Rumex*, *Urtica*). The tests were done on the palmar surface of both forearms.

Reactions were read at 15 minutes by use of a millimeter ruler. A whealing reaction was compared to the size of a positive histamine control (1 mg/ml) and to a negative control according to the Standardization Committee of the Northern (Scandinavian) Society of Allergy.<sup>3</sup> A wheal of the same size as that induced by histamine control is indicated as + + +, and a reaction similar to that induced by the negative control is indicated as -. The gradings + and + + are used for reactions between the negative and the positive control. For reactions larger than + + +, a + is added for each doubling of the average diameter.

**TABLE II.** Percent frequency of SPT positivity

Allergens	Children (%)	Adults (%)
<i>Dermatophagoides</i>	76.90	40.12
<i>Parietaria</i>	26.94	63.80
Grasses	17.98	30.54
Olive	7.02	9.90
Mugwort	5.01	9.80
Cat	5.95	8.30
Dog	4.03	4.30
<i>Alternaria</i>	7.49	4.82
Other molds	3.70	5.24

Percent frequency of SPT positivity to various aeroallergens, allowing for polysensitization also, in 2649 patients of both sexes (1019 children and 1630 adults) with rhinitis and/or asthma examined consecutively from January 1, 1981, to May 30, 1983. Remarkable reduction in adults of the frequency of SPT positivity to *Dermatophagoides* and very high increased frequency of SPT positivity to various pollinic families (particularly *Parietaria* and grasses).

## RESULTS

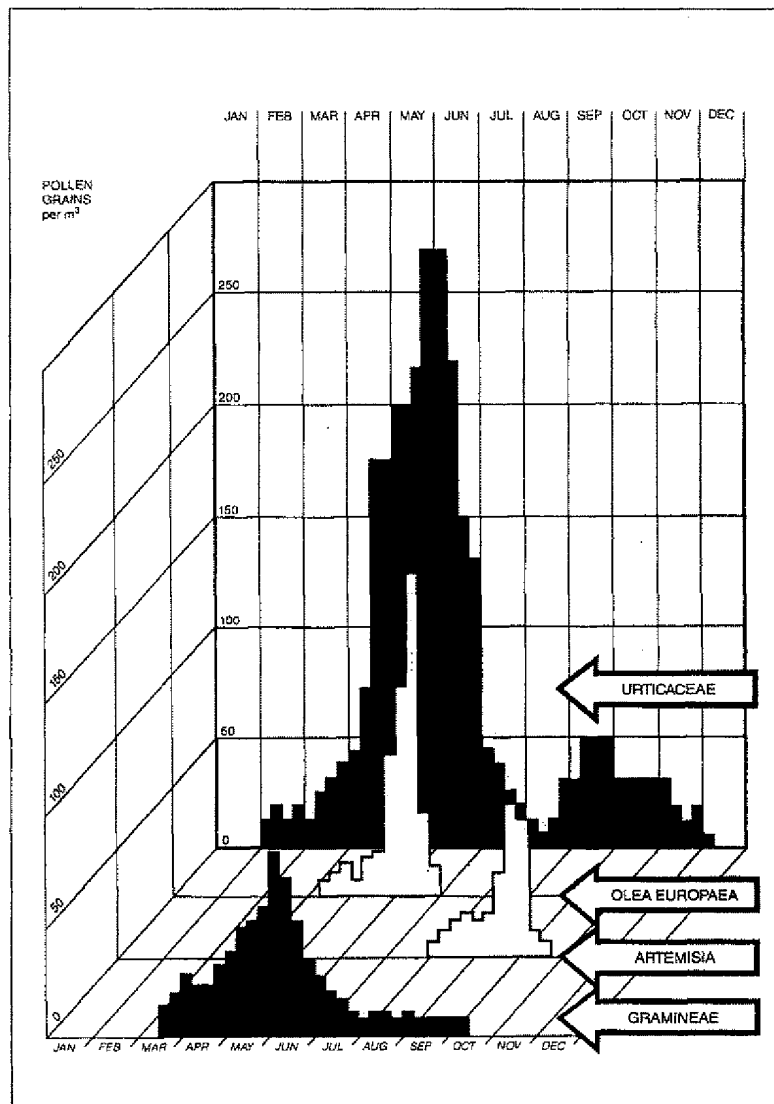
### Aerobiologic monitoring

The behavior of the most important allergenic pollens in the air of Naples is illustrated in Figs. 2 to 3 and in Table I.

*Parietaria* (Fig. 1), an Urticaceae (pellitory-of-the-wall), has two very long cycles of flowering (Figs. 2 and 3). Its pollen first appears during the initial warm period in late winter. Pollen persist throughout the spring and summer months and often reach a peak level with pollen grains  $>300$  to  $400/\text{m}^3$  of air as daily mean value from the end of April, as well as in May, and the beginning of June. A second generally lower peak is often registered at the end of August and September, after which it diminishes until it disappears during the colder months of December and January. Since the microscopic analysis of *Urtica* and *Parietaria* does not make it possible to distinguish accurately between them in spite of differences in size, we prefer to define Urticaceae as the pollen of both species found in the aerobiologic sampling (Figs. 2 and 3).

The pollination period of Gramineae (Poaceae) is shorter than that of *Parietaria* and starts at the end of March, continuing until the end of June, and then decreases in July (Fig. 2). The atmospheric concentration of Gramineae pollen grains rarely reaches peak level of  $100/\text{m}^3$ .

The *Olea* (Fig. 1) pollination period lasts from the middle of April to the end of June (Fig. 2). During the peak period in Naples, pollen grains  $>100/\text{m}^3$  of



**FIG. 2.** Behavior of the most important allergenic pollens in the atmosphere of Naples (weekly mean values from daily pollen counts in various years from May 1, 1979, to October 30, 1987).

air as daily mean value can be observed. We rank other pollens, in terms of grains per cubic meter of air, taken in order, as *Corylaceae*, *Alnus*, *Platanus*, *Artemisia vulgaris* (which reaches concentrations of pollen grains  $>50/\text{m}^3$  of air in the last week of August and in September) (Fig. 2), *Cupressaceae*, and *Chenopodiaceae* (Table I).

### SPT results

The percent frequency of positive skin reactions for all studied allergens, perennial and seasonal, in the group of 2649 patients of both sexes is summarized in Table II. The percent values have been calculated

on the total of skin test positive patients, considering also the polysensitizations, separately for children and adults. In the children's group (Fig. 4) we find a very high rate of positive SPT responses to *Dermatophagoides* (76.90%) and a clearly lower frequency of positivity to pollens. This situation is reversed in the adult group in which, at first place, we find the sensitization to *Parietaria* (63.80%) (Table II and Fig. 4). SPT results in the group of patients with only pollen positivity are presented in Table III. In Table I we find three examples of studies carried out at three different European locations, with combined observations on aerobiologic and allergologic frequency.

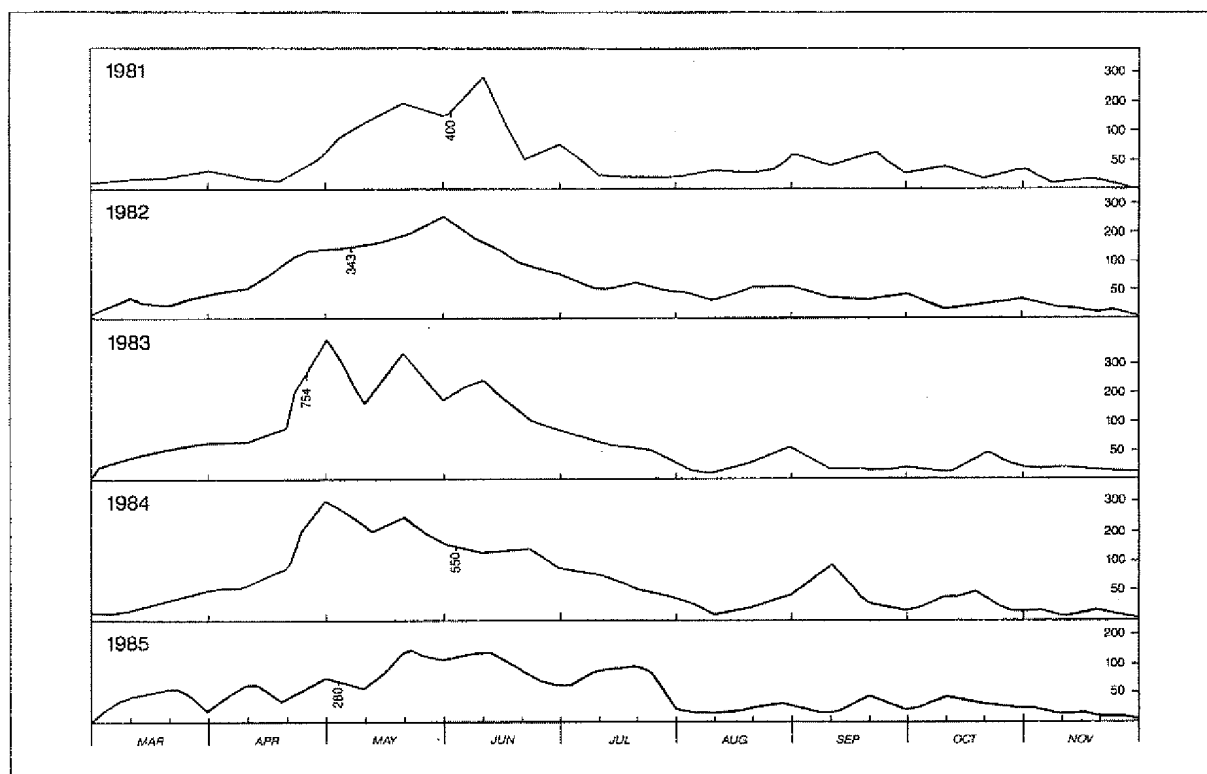


FIG. 3. Daily counts of airborne Urticaceae pollen in 5 successive years (1981 to 1985) in Naples, Italy. The curves are based on 10-day running means of pollen counts (per cubic meter in 24 hours). The maximum day count of the season is also indicated.

TABLE III. Percent frequency of SPT positivity to various pollen species

Pollens	% Frequency (SPT positivity)
<i>Parietaria</i> (Pellitory-of-the-wall)	82.02
Poaceae (grasses)	38.12
<i>Olea europaea</i>	23.11
<i>Artemisia vulgaris</i> (mugwort)	17.08
<i>Plantago</i> (plantain)	7.41
<i>Chenopodium</i> (fat hen)	3.09
<i>Platanus</i> (plane)	2.58
Cupressaceae (cypress and juniper)	2.47
<i>Corylus</i> (hazel)	2.18
<i>Betula</i> (birch)	2.04
<i>Alnus</i> (alder)	1.98
<i>Urtica</i> (nettle)	1.04
<i>Rumex</i> (sorrel)	1.02

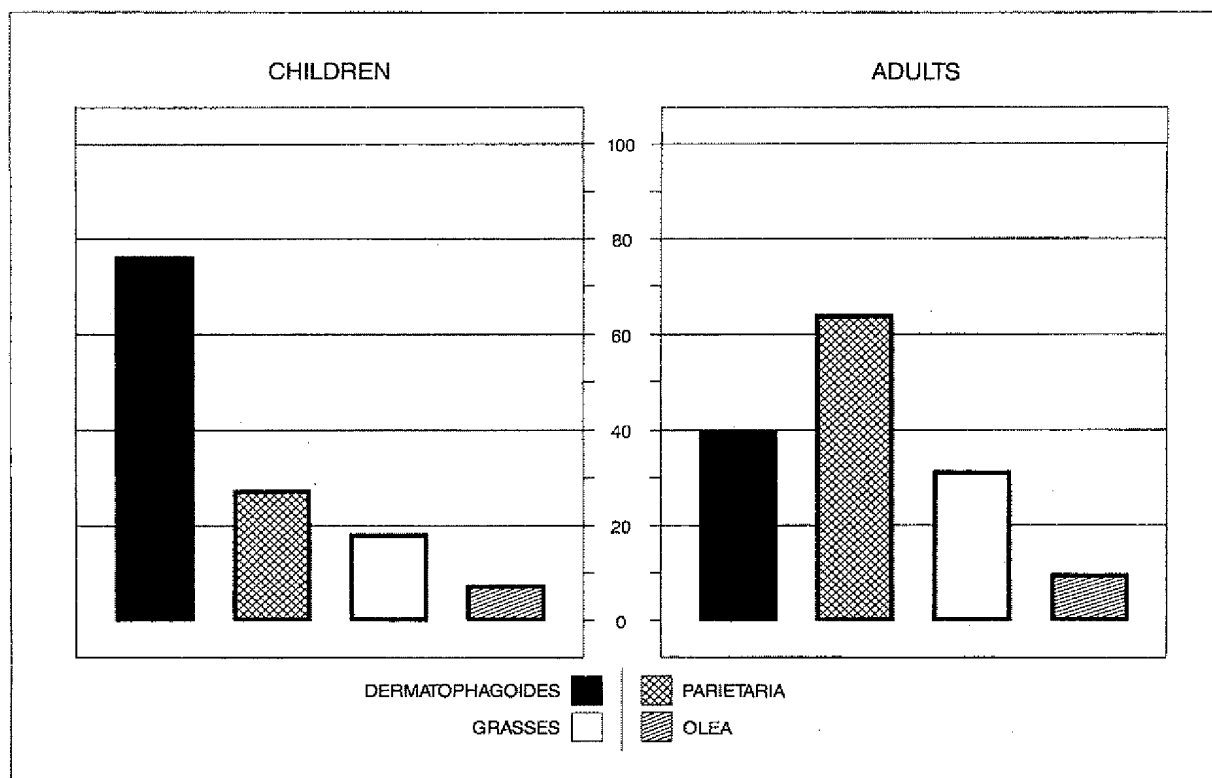
Percent frequency of SPT positivity to various pollen species in 785 patients with pollinosis of both sexes, from 4 to 60 years of age, born and living in the Naples, Italy, area, examined consecutively from January 1, 1981, to May 30, 1983.

## DISCUSSION

Data on the presence and prevalence of allergenic airborne pollens, obtained from aerobiologic studies and from allergologic investigations, make it possible to design a pollen calendar with the approximate flowering period of the plants in the area in which the sampling is carried out.<sup>4,5</sup> In this way it is possible to compare the chances for high atmospheric allergenic pollen concentrations in different areas, which can be useful information for the allergic patient when his travels are being planned or in preventing the possible appearance of severe hay fever symptoms by appropriate medication or other measures.

In the Mediterranean area we find a typical vegetation with the presence of some allergenic plants, such as *Parietaria* and *Olea europaea*, besides various species of Gramineae and mugwort<sup>6-8</sup> (Fig. 2).

The aerobiologic sampling of the pollen content of the air in Naples, carried out from May 1, 1979, to October 30, 1987, led us to identify three pollen seasons: (1) a low winter season marked by the presence of the pollens of such trees as the hazel, Cupressaceae,



**FIG. 4.** Percent frequency of SPT positivity to the five more important aeroallergens in southern Italy in one group of 2649 atopic patients of both sexes (1019 children and 1630 adults) examined consecutively from January 1, 1981, to May 30, 1983. The remarkable reduction of the frequency of SPT positivity to *Dermatophagoides* and the increased frequency of SPT positivity to various pollinic families is evident in the adults.

alder, and elm. These tree pollens, although they are produced in fairly large quantities, are of only slight allergologic interest (Tables I and III), (2) a high spring-summer pollen season of marked allergologic interest, dominated by the pollination of *Parietaria*, *Olea*, and Gramineae. In this period, from March to May, we find also the *Platanus* pollination, which has a very low allergenic importance (Tables I and III), and (3) a summer-autumn season, in which we find the second, lower peak of *Parietaria* pollination and the pollens of herbaceous plants, such as mugwort (Fig. 2) and Chenopodiaceae.

*Parietaria*, an Urticacea, is the most important hay fever-provoking plant in Naples and in southern Italy.<sup>6-8</sup> *Parietaria*, whose very strong allergenic components are now known,<sup>9-13</sup> grows especially on walls inside the towns and has two very long cycles of flowering (Figs. 2 and 3). During the spring, especially from April to the end of June, the largest pollination period of *Parietaria* takes place. A lower pollination period is from the end of August to October.

Among the different species, the most common species in Italy are *P. officinalis* and *P. judaica*, which have different distribution areas, the latter being widespread all over Italy, particularly in southern Italy, whereas *P. officinalis* is mainly present in northern and central Italy. In allergenic activity of *P. officinalis* and *P. judaica*, there is cross-reactivity between these two species<sup>14-16</sup> and not between *Parietaria* and *Urtica*. The frequency of SPT positivity to *Parietaria* in our symptomatic atopic patients is 26.94% in children and 63.80% in adults (Table II and Fig. 4). If we consider only the patients with pollinosis on the whole (children and adults), the percent frequency of SPT positivity to *Parietaria* alone or in association with other pollens, (more frequently with Gramineae) is 82.02% (Table III). The clinical manifestations of pollinosis caused by *Parietaria* are present for a long period, often multiseasonal, particularly in spring and sometimes also in autumn. Asthma symptoms are present in 66.26% of the patients with pollinosis with allergic monosensitization to *Parietaria* pollen.<sup>8</sup> Gra-

mineae represents the second etiologic factor of pollinosis in southern Italy, whereas Gramineae comes first in northern Italy and more extensively in Europe.<sup>17, 18</sup> The average atmospheric values of Gramineae pollen concentration, much lower in southern Italy in comparison with the northern area, are connected with the higher temperature in the South, leading to rapid drying of the grasses. The Gramineae pollination period starts at the end of March with the beginning symptoms in April. The flowering continues until the end of June and then decreases in July (Fig. 2). In the frequency of SPT positivity to Gramineae, we observe values of 38.12% in the patients with pollinosis (Table III), and this grass pollen positivity is frequently associated with that of *Parietaria*.

*Olea europaea*, which is the pollen responsible for frequently severe pollinosis,<sup>19-22</sup> has a pollination period lasting from the middle of April to the end of June (Fig. 2). In our study the frequency of SPT positivity, considering only the patients with pollinosis, is of 23.11%. In southern Italy, the allergic sensitization to *Olea* follows *Parietaria* and Gramineae frequency, but in some areas, like Puglia, is more frequent than that induced by Gramineae.<sup>19</sup>

Among other pollens, at fourth place in southern Italy in terms of frequency of SPT positivity between pollinic families, we find a Composita, the mugwort (*Artemisia vulgaris*), which has its flowering period from August to October. Other pollens in southern Italy have a minor allergologic importance. Among these are found herbaceous plants, such as *Plantago* and *Chenopodium*. With trees other than *Olea*, the allergologic interest is limited to areas in which they are present for ornamental (*Cupressus* and *Platanus*) or food purposes (*Corylus avellana*), particularly hazel, which is responsible for some cases of pollinosis during the winter in some area of southern Italy.

In conclusion, pollinosis of the central Mediterranean area is quite different from the pollinosis of the northern part of the area and the other parts of Europe.<sup>17, 18</sup>

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